

Cover Crop Net Returns and Soil Health Improvements

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INTRODUCTION

For most farms, conservation is only one of several farm goals, which in addition to conservation may include risk reduction, profitability, farm transfer to a younger generation, and reduction in debt. How does a farm consider these other farm goals? This paper addresses this question by developing a conceptual framework that can be used to examine farm goal tradeoffs, with particular emphasis on the tradeoff between conservation and profitability.

TRADEOFFS BETWEEN FARM GOALS

As noted above, it is uncommon for a farm to have a single goal, such as profit maximization or soil conservation. Having a hierarchy of goals is important because goals may conflict with one another. For example, safety-first risk models first ensure that downside risk is amenable and then maximize profits. As another example, a farm could establish a specific target with regard to soil erosion and then maximize profits given this target. It is important to keep in mind that each farm prioritizes goals in a different manner. This means that there is not a “correct answer” or “unique answer” to the tradeoff examples discussed in this paper.

A recent survey (Langemeier and Balchhaudi, 2025) asked producers to identify their most important farm goal. Choices including the following: maintain stable income, conservation, profit maximization, pass the farm onto the next generation, and reduce debt over time. Survey results are illustrated in Figure 1. Farm transfer was chosen by 34.0% of the respondents as being the most important farm goal. Profit maximization and reduction in debt were chosen by another 21.5% and 19.5%, respectively. The remaining two farm goals (i.e., stable income and conservation) were chosen by 15% and 10% of the respondents.

SCENARIO ANALYSIS

Scenario analysis (sometimes referred to as scenario planning) is a planning and risk management technique that can be used to evaluate the potential impact of key management decisions (Courtney et al., 1997; Schwartz and Randall, 2007). Plausible scenarios are developed to determine the impact of each scenario on key performance indicators. In the process, businesses can prepare for various possibilities, make informed decisions, and develop more flexible and resilient strategies. Scenario analysis is often used in situations involving uncertainty (i.e., situations where there is limited data pertaining to outcomes and the probabilities of these outcomes). Scenarios are used in this paper to examine the tradeoff between profit maximization and attaining conservation targets. Profitability is measured using net returns per acre while soil health is proxied using estimates of soil loss and GHG emissions, and an overall soil health score. The primary data sources for the scenarios were as follows: the Soil Health Matrix Decision Tool, the most recent Precision Conservation Management report, and Langemeier (2024).

Table 1 illustrates the first case which introduces a cover crop to a corn/soybean rotation. The adoption of a cover crop reduced soil loss, reduced GHG emissions, and improved the overall soil health score from -0.5 to 0.0. The drop in yield for corn and soybeans associated with the use of cover crops was 8 and 3 bushels per acre, respectively. Due to differences in gross returns and costs, net returns per acre for the corn/soybean rotation declined by \$36 per acre with the use of cover crops. The large decline in net returns is consistent with the relative low use of cover crops in Iowa, Illinois, and Indiana reported in Plastina et al. (2024).

Table 1. Scenario Analysis for Cover Crop Use, No Cost Savings or Closure of Yield Gaps.

Planned Practices (Case 1)
Reduced Till (1-Pass Light)
Cover Crop; Single Species
Corn/Soybean Rotation
No Manure
Changes Resulting from Planned Practices
Net Return Change = -\$36 per acre
Corn = -\$27 per acre
Soybeans = -\$46 per acre
Estimated Soil Loss (tons per acre)
Corn: Decreased from 1.41 to 0.82
Soybeans: Decreased from 2.06 to 1.30
GHG Emissions (metric tons CO₂ e per acre)
Corn: Decreased from 0.80 to 0.49
Soybeans: Decreased from 0.00 to -0.26
Overall Soil Health Score (higher = better)
Improved from -0.5 to 0.0

As noted by Chen (2025), the benefits associated with cover crops often accrue over time. To account for this fact, we created scenarios below for which the fertilizer and herbicide costs dropped by \$20 per acre for both corn and soybeans (table 2) and for which the corn and soybean yield gaps between the no cover crop scenario and cover crop use scenario shrunk to zero over a ten-year period (table 3).

Table 2. Scenario Analysis for Cover Crop Use, Cost Savings of \$20 per Acre.

Planned Practices (Case 2)

Reduced Till (1-Pass Light)

Cover Crop; Single Species

Corn/Soybean Rotation

No Manure

Changes Resulting from Planned Practices

Net Return Change = -\$16 per acre

Corn = -\$7 per acre

Soybeans = -\$26 per acre

Estimated Soil Loss (tons per acre)

Corn: Decreased from 1.41 to 0.82

Soybeans: Decreased from 2.06 to 1.30

GHG Emissions (metric tons CO₂ e per acre)

Corn: Decreased from 0.80 to 0.49

Soybeans: Decreased from 0.00 to -0.26

Overall Soil Health Score (higher = better)

Improved from -0.5 to 0.0

Table 3. Scenario Analysis for Cover Crop Use, Closure of Yield Gaps in 10 Years.

Planned Practices (Case 3)

Reduced Till (1-Pass Light)

Cover Crop; Single Species

Corn/Soybean Rotation

No Manure

Changes Resulting from Planned Practices

Net Return Change = -\$6 per acre

Corn = -\$4 per acre

Soybeans = -\$9 per acre

Estimated Soil Loss (tons per acre)

Corn: Decreased from 1.41 to 0.82

Soybeans: Decreased from 2.06 to 1.30

GHG Emissions (metric tons CO₂ e per acre)

Corn: Decreased from 0.80 to 0.49

Soybeans: Decreased from 0.00 to -0.26

Overall Soil Health Score (higher = better)

Improved from -0.5 to 0.0

The impact of a potential reduction in fertilizer and costs on cover crop use is illustrated in table 2. Changes in soil loss, GHG emissions, and the overall soil health score are the same as they were in table 1. In this case, the drop in rotational net returns falls to \$16 per acre. If cost reductions are possible with the use of cover crops, the decision to use cover crops becomes more difficult.

Table 3 illustrates the use of cover crops assuming the yield gaps between corn and soybeans associated with the use of cover crops shrink to zero over a 10-year period. Again, the changes in soil loss, GHG emissions, and overall soil health score remain the same as those illustrated in table 1. In this case, the decline in net returns for the rotation is only \$6 per acre. Those for which the conservation goal is very important and/or that prioritize long-run goals rather than short-run profits would certainly find cover crops more appealing under the assumptions in table 3.

Using scenario analysis does not provide an optimal solution when farm goals are multi-dimensional. Rather, it provides a mechanism to explore how a change in the operation impacts

multiple goals. Given this, how would a farm use the information in tables 1-3? A farm that ranks soil conservation as their most important goal may prefer scenarios that improve soil health over scenarios with less attractive soil health characteristics. Conversely, a farm that ranks profit maximization as their most important goal, but is also concerned about soil health, may only adopt conservation practices that have a minimal impact on net returns.

CONCLUSIONS

This article develops a conceptual framework that can be used to examine tradeoffs between soil conservation, profitability, and other farm goals. The conceptual framework is illustrated by examining tradeoffs between conservation and profit maximization. Scenario planning is used to compare scenarios that depict current practices with planned practices. Specifically, scenarios address the adoption cover crops with various assumptions regarding the impact of cover crops on net returns. Unless fertilizer and herbicide costs are reduced and/or the yield gap between crops grown with and without cover crops is reduced over time, farmers that focus on profit maximization would be cautious in their adoption of cover crops.

More information on the examination of tradeoffs between conservation and profitability can be found in Langemeier (2026). In particular, this article discusses scenario analysis related to the adoption of no-till practices and the addition of a winter wheat to a corn/soybean rotation.

CITATIONS

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